NISTIR 6030

THIRTEENTH MEETING OF THE UJNR PANEL ON FIRE RESEARCH AND SAFETY, MARCH 13-20, 1996

VOLUME 2

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June 1997
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PROGRESS REPORT ON FIRE SUPPRESSION RESEARCH IN THE U.S.

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ABSTRACT

Dramatic changes in the field of fire suppression have taken place in the 3½ years since the 12th meeting of the UJNR Panel on Fire Research and Safety. Research on and qualification of alternatives to halon 1301 are in process. The use of sprinkler systems in the United States has proliferated.

1. HALON ALTERNATIVES

F. Sherwood Rowland and Mario Molina received the 1995 Nobel Prize for Chemistry for their findings in 1974 that chlorine atoms, transported into the stratosphere, catalyze the destruction of stratospheric ozone. Subsequent calculations showed that bromine atoms were even more harmful. Halon 1301 (CF_3Br), the suppressant of choice where 'clean' fire suppression is needed, was then identified as a significant contributor to this environmental hazard. Under the amendments to the international *Montreal Protocol on Substances that Deplete the Ozone Layer* and the U.S. *Clean Air Act of 1990*, production of new halon 1301 stopped on January 1, 1994, with limited allowances made for developing nations. The supply of this suppressant for non-essential systems became scarce, and many users of this technology began searching for other approaches. Because the military has extensive near-term essential fire protection needs, they have been buying halon 1301 from organizations that have discontinued its use. A market in re-cycled (purified) 1301 has also emerged.

Research on and testing of alternative suppression technologies has been dominated by the U.S. Department of Defense. Many of the systems being protected by halon 1301 are essential to military readiness; and in 1991, the Department of Defense initiated an urgent program to identify near-term alternatives for weapons systems use, mostly by September, 1996. This research focusses on commercially available or currently emerging chemicals and technologies. Most of the current resources are focussed on testing HFCs (chemicals containing hydrogen, fluorine and carbon) and FCs (chemicals containing only carbon and fluorine) and qualifying them for commercial and military use. For instance, HFC-227ea (C_3HF_7) is being considered for use in the fixed fire suppression systems aboard ships and HFC-125 (C_2HF_5) is being considered for use in the engine nacelles of developmental aircraft. The National Fire Protection Association (NFPA) has issued the first standard for systems using alternatives to halon 1301.

A lesser amount of research is aimed at new chemicals and approaches. The former include chemically-generated suppressants and phosphorous nitrides; CF_3I has potential, but for

unoccupied spaces only due to its cardiac sensitization. The latter include water mist systems and the use of propellants (such as found in automobile air bags) to generate inert gases rapidly. Papers on all of these conventional and new approaches can be found in the proceedings of the annual *International CFC and Halon Alternatives Conference* and the *Halon Options Technical Working Conference*. A recent special American Chemical Society symposium volume contains more detailed papers. A number of papers appear in the proceedings of the *International Conference on Fire Research and Engineering*. Two extensive NIST Special Publications describe a variety of technological advances in the mechanisms and performance of alternative fire suppressants.

The currently available commercial agents occupy two-to-three times the space and volume of halon 1301; using these, the cost of retrofitting aircraft, ground armored vehicles, etc. is estimated in the many billions of dollars. To ensure the availability of more efficient suppression technology, the Department of Defense is initiating a Next Generation Fire Suppression Technology program. The goal is to develop, by 2005, environmentally-friendly and user-safe processes, techniques and fluids that meet the operational requirements currently satisfied by halon 1301systems in ships, aircraft, land combat vehicles, and critical mission support facilities. The program includes research on risk assessment and selection methodology, fire suppression principles, technology testing methodologies, new suppression concepts, emerging technology assessment, and suppression optimization. A published description of the program is due this spring.

2. SPRINKLERS

A notable advance during the past 3 years has been the expansion of occupancies requiring sprinklers. The list now includes high rise commercial buildings, hotels and motels, and multi-family residences. In large part, this is due to, first, the adoption by local authorities of such provisions in the NFPA Life Safety Code, and second, the allowed construction trade offs (*e.g.*, reduction in fire ratings of walls). In addition, (U.S.) Public Law 102-522 (1992) required the General Services Administration to install sprinklers in Federally-occupied buildings with over 25 employees and established sprinkler requirements for housing under the jurisdiction of the U.S. Department of Housing and Urban Development.

The use of water sprinklers is a mature technology, and the changes over the past few years have been in system design and code acceptance. For instance, the NFPA 13D standard has been modified with a provision for residences not exceeding 186 m^2 (2000 ft^2) in area. NFPA is also developing the first standard for the installation of water mist systems (NFPA 750). This is expected in May, 1996.

3. ACKNOWLEDGMENTS

Dan Madrzykowski and Richard Bukowski of NIST provided the author with the materials for the section on sprinklers.

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